PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Applicant's or agent's file reference 1789-13901	Date of mailing (*day/month/year*) 06 FEB 2006 **FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US05/04125	09 February 2005 (09.02.2005)	09 February 2004 (09.02.2004)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): G01N 21/61 and US Cl.: 356/437

Applicant

WILLIAM MARSH RICE UNIVERSITY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	27 January 2006 (27.01.2006)	Richard Rosenberger Telephone No. 571-272-2428

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Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ on paper

☐ in electronic form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in electronic form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 2-13, 15-21	YES
	Claims 1, 14	NO
Inventive step (IS)	Claims 12, 21	YES
	Claims 1-11, 13-20	NO
Industrial applicability (IA)	Claims 1-21	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

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Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1 and 14 lack novelty under PCT Article 33(2) as being anticipated by Hammerich et al (US 5,159,411). Hammerich et al show a method and an apparatus for the detection of a target fluid ("a first gas" in the abstract) in a fluid sample ("a gas mixture" in the abstract) by providing an optical signal (11) form a light source (10) to the fluid sample, modulating the optical signal at a desired optical frequency (by trigger 70) to generate acoustic signals in the fluid sample, measuring the acoustic signals with an acoustic transducer (30), and using the phase of the acoustic signal to detect the presence of the target fluid (abstract, lines 9-10; column 4, lines 41-46).

Claims 2-8, 10-11, 13, and 15-20 lack an inventive step under PCT Article 33(3) as being obvious over Hammerich et al (US 5,159,411).

See above for a discussion of the Hammerich et al reference.

The reference at least suggests a functional relationship between the modulation frequency and the phase lag; see column 4, lines 49-52, which states that a particular frequency "is found convenient leading to a phase delay of typically 120 degrees". It would have thus been obvious to choose a frequency which "optimizes" the phase lag as in claim 13; indeed, it appears that the reference has done this, considering 120 degrees "optimal" for its purposes. Such a frequency would inherently fall within the ranges that produce such "optimal" results, and thus will , as understood, due to the underlying physical mechanism being exploited by the reference, be greater that the relaxation rate or the inverse of the relaxation time and in clams 2, 15 and 20.

In relation to figure 2, the reference discusses how the phase change can be treated as vectors with a phase orientation angle. Given this discussion, it would have been obvious, as in claims 3 and 16, to choose to use the phase rotation angle, that is the difference between the vectors A and C in figure 2 of the reference, to determine the difference of interest, shown as vector B in figure 2. Choosing a phase angle which is "optimum", as in claims 4 and 17, would have been obvious because other angles would give poorer results. In the vectors of figure 2 of the reference, the common component of vectors A and C is the common components between the measurements, and thus will represent the common contributions of the first fluid and the instrument phase lag, which will thus, by the process of finding vector B, will suppress signal contributions form those sources as in clams 5 and 6. The rotation of the vectors can be considered as an adjustable reference frame, as in claims 7 and 18; it is at least obvious to initialize this "adjustable reference frame" to a predetermined value, as in claim 8.

The reference teaches obtaining an in-phase signal ("the same period and phase as the microphone signal"; column 4, line 4) and a quadrature -phase signal ("the same period ... but differeing in having its phase displayed by 90 degrees"; column 4, lines 5-8), as in claim 9.

The lock-in amplifier (60) of the reference is a "single receiver having an adjustable phase" set by the signal form trigger 70, as in claim 10.

The reference discloses that the molecules in the gas are "exited" by the absorption of the light of the correct frequency; such excitation appears to be the "resonates" of claims 11 and 19.

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Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

Claims 12 and 21 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the details of these claims. The prior art does not teach or suggest the use of modulation rate of greater than 30 kHz as in claims 12 and 21; the reference teaches a much lower rate of about 700 Hz (column 4, lines 49-50).

Claims 1-21 meet the criteria set out in PCT Article 33(4), and thus possess industrial applicability because the subject matter claimed can be made or used in industry.